

WHAT IS CLAIMED IS:

1. A method for assembling a gas turbine engine, said method comprising:

coupling a combustor including a dome assembly and a combustor liner that extends downstream from the dome assembly to a combustor casing that is positioned radially outwardly from the combustor;

coupling a fuel injector including a fuel inlet and an air inlet to the combustor casing such that the fuel injector extends axially through the dome assembly such that fuel may be discharged from the primer nozzle into the combustor; and

coupling the air inlet to an air source such that cooling air received therethrough is circulated through the fuel injector to facilitate cooling the fuel injector.

2. A method in accordance with Claim 1 further comprising coupling an annular ring support that includes a first radial flange, a second radial flange, and a plurality of beams that extend therebetween to the combustor casing such that the fuel injector is positioned radially inwardly from the ring support.

3. A method in accordance with Claim 1 wherein coupling a fuel injector including a fuel inlet and an air inlet to the combustor casing further comprises coupling the fuel injector to the combustor casing such that fuel is discharged from the fuel injector into the combustor in a direction that is substantially parallel to a centerline axis extending through the combustor.

4. A method in accordance with Claim 1 further comprising coupling the fuel injector fuel source to an air source to facilitate purging residual fuel from the fuel injector into the combustor during pre-determined combustor operations.

5. A method in accordance with Claim 1 wherein coupling the air inlet to an air source further comprises coupling the air inlet to an air source such that spent cooling air is discharged from the fuel injector external to the combustor casing.

6. A method in accordance with Claim 1 wherein coupling a fuel injector including a fuel inlet and an air inlet to the combustor casing further comprises coupling the fuel injector to the combustor casing such that an annular shoulder extending from the fuel injector orients the fuel injector with respect to the combustor.

7. A fuel injector for a gas turbine engine combustor including a centerline axis, said fuel injector comprising:

a fuel inlet;

an injection tip for discharging fuel into said combustor in a direction that is substantially parallel to the gas turbine engine centerline axis; and

a body extending between said inlet and said injection tip, said body comprising at least one air inlet and at least one air outlet, said inlet for receiving cooling air within said body, said outlet for discharging cooling air external to the engine.

8. A fuel injector in accordance with Claim 7 further comprising a shroud extending around said injection tip, said tip supplied recuperated air for atomization of fuel discharged from said fuel injector.

9. A fuel injector in accordance with Claim 7 wherein said at least one body air inlet is coupled in flow communication to an air source for receiving unrecuperated air for cooling said fuel injector.

10. A fuel injector in accordance with Claim 7 wherein said body further comprises an annular shoulder extending radially outward therefrom, said shoulder comprising a plurality of openings extending therethrough, each said opening

sized to receive a fastener therethrough for securing said fuel injector to the combustor.

11. A fuel injector in accordance with Claim 7 wherein said body further comprises an annular shoulder extending radially outward therefrom, said shoulder facilitates orienting said fuel injector with respect to the combustor.

12. A fuel injector in accordance with Claim 7 wherein said fuel inlet is coupled to an accumulator for use in purging residual fuel from said fuel injector into the combustor during pre-determined combustor operating conditions.

13. A combustion system for a gas turbine engine, said combustion system comprising:

a combustor comprising a dome assembly and a combustor liner extending downstream from said dome assembly, said combustor liner defining a combustion chamber therein, said combustor further comprising a centerline axis;

a combustor casing extending around said combustor; and

a fuel injector extending through said combustor casing and said dome assembly, said fuel injector comprising a fuel inlet, an injection tip, and a body extending between said fuel inlet and said injection tip, said injection tip for discharging fuel into said combustor, said body comprising at least one air inlet and at least one air outlet, said inlet for receiving cooling air within said body, said outlet for discharging cooling air external to the combustor case.

14. A combustion system in accordance with Claim 13 further comprising an annular support ring comprising a first radial flange, a second radial flange axially spaced from said first radial flange, and a plurality of circumferentially-spaced beams extending between said first radial flange and said second radial flange, said combustor casing coupled to said annular support ring.

15. A combustion system in accordance with Claim 14 wherein said fuel injector is coupled to said combustor casing radially inwardly from said annular support ring.

16. A combustion system in accordance with Claim 13 wherein said fuel injector further comprises an annular shoulder extending outwardly from said body, said shoulder comprises at least one opening extending therethrough used for coupling said fuel injector to said combustor casing such that said fuel injector is oriented with respect to said combustor.

17. A combustion system in accordance with Claim 13 wherein said fuel injector injection tip is configured to discharge fuel therefrom into said combustor in a direction that is substantially parallel to said combustor centerline axis.

18. A combustion system in accordance with Claim 13 wherein said fuel injector further comprises a shroud extending circumferentially around said injection tip.

19. A combustion system in accordance with Claim 13 wherein said fuel injector fuel inlet is coupled to an air source used for purging residual fuel into said combustor from said primer nozzle during pre-determined combustor operating conditions.

20. A combustion system in accordance with Claim 13 wherein said fuel injector injection tip is supplied recuperated air to facilitate atomizing fuel discharged from said fuel injector, said fuel injector at least one body inlet coupled to an air source for supplying unrecuperated cooling air to said fuel injector.